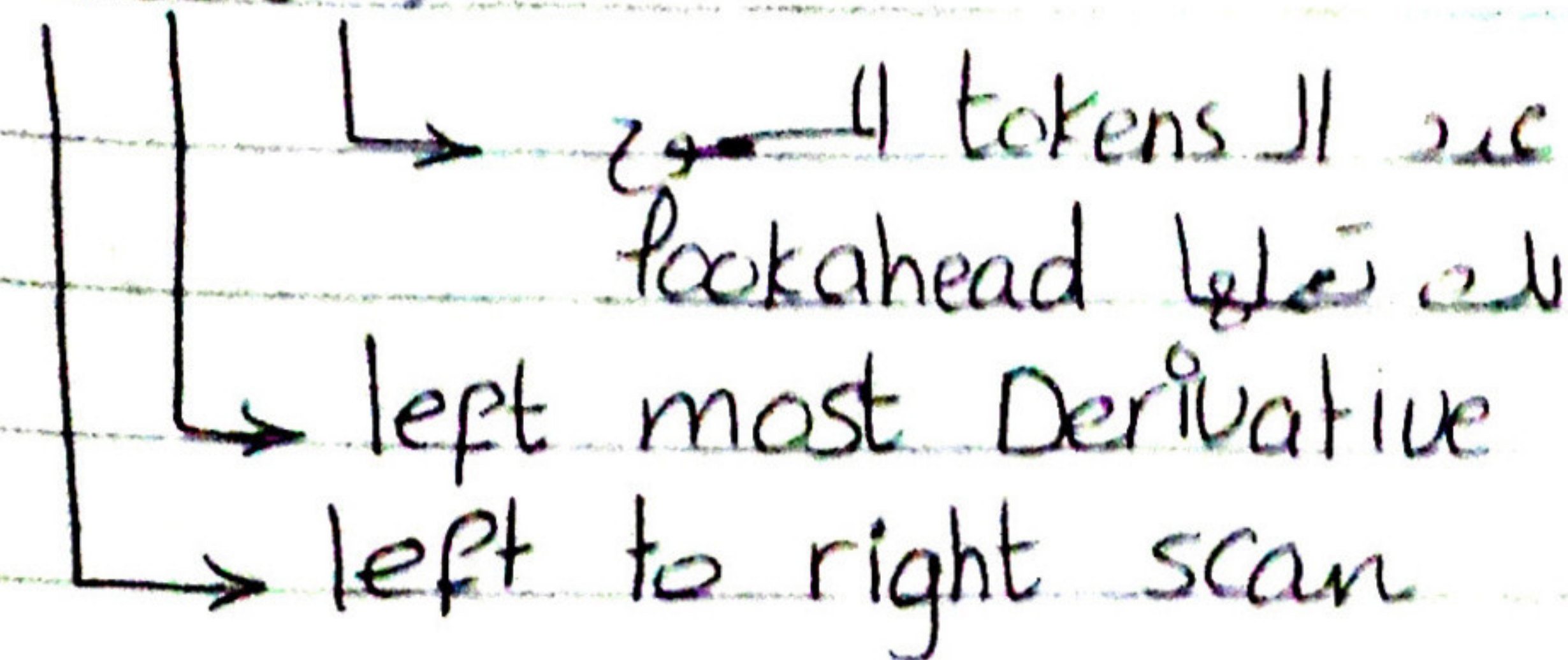


LL(k)



LL(1):

Single production rule is applied at a time

? Left factor slide 6

① nonterminals $E \in T$

② 1 production rule

$$E \rightarrow TX$$

$$X \rightarrow +E \mid \epsilon$$

$$T \rightarrow (E) \mid \text{int } Y$$

$$Y \rightarrow *T \mid \epsilon$$

Quiz slide 8: (d) (south east)

LL(1): 1 production rule cell في الجدول فيها

not LL(1): الترميز

Stack	input	Action	Pointer at the top of the stack
E\$	int * int \$ ↑ pointer	TX	Replace & Retain. Pop top of stack Push entry of cell r.h.s of Production rule
<div> <div>TX</div> <div>E</div> <div>\$</div> </div>	<div> <div>int</div> <div>X</div> <div>\$</div> </div> <div>int Y</div>		
TX\$	int * int \$ ↑ int	int Y	
<div> <div>int</div> <div>Y</div> <div>X</div> <div>\$</div> </div>	<div> <div>Y</div> <div>X</div> <div>\$</div> </div> <div> <div>T</div> <div>X</div> <div>\$</div> </div> <div> <div>Y</div> <div>X</div> <div>\$</div> </div> <div> <div>X</div> <div>\$</div> </div>		
int YX\$	int * int \$ ↑	terminal	Pop & Advance
Pop also match & check * in the pointer & advance			
YX\$	* int \$ ↑	*T	
*TX\$	* int \$	terminal	Pop & Advance
TX\$	int \$	int Y	
int YX\$	↑ int \$	terminal	replace
YX\$	\$	ε	replace
X\$	\$	ε	replace
\$	\$	ε	<u>Accept</u>

Quiz slide 16 :  (2nd)

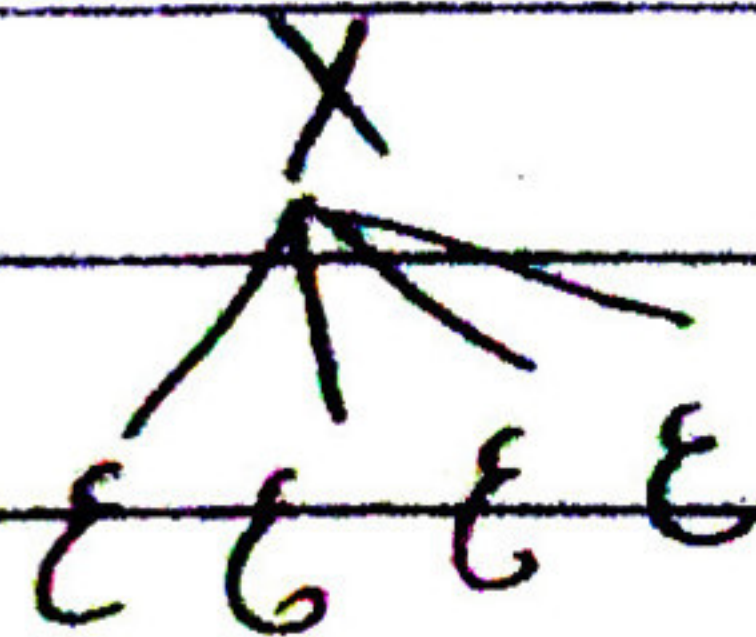
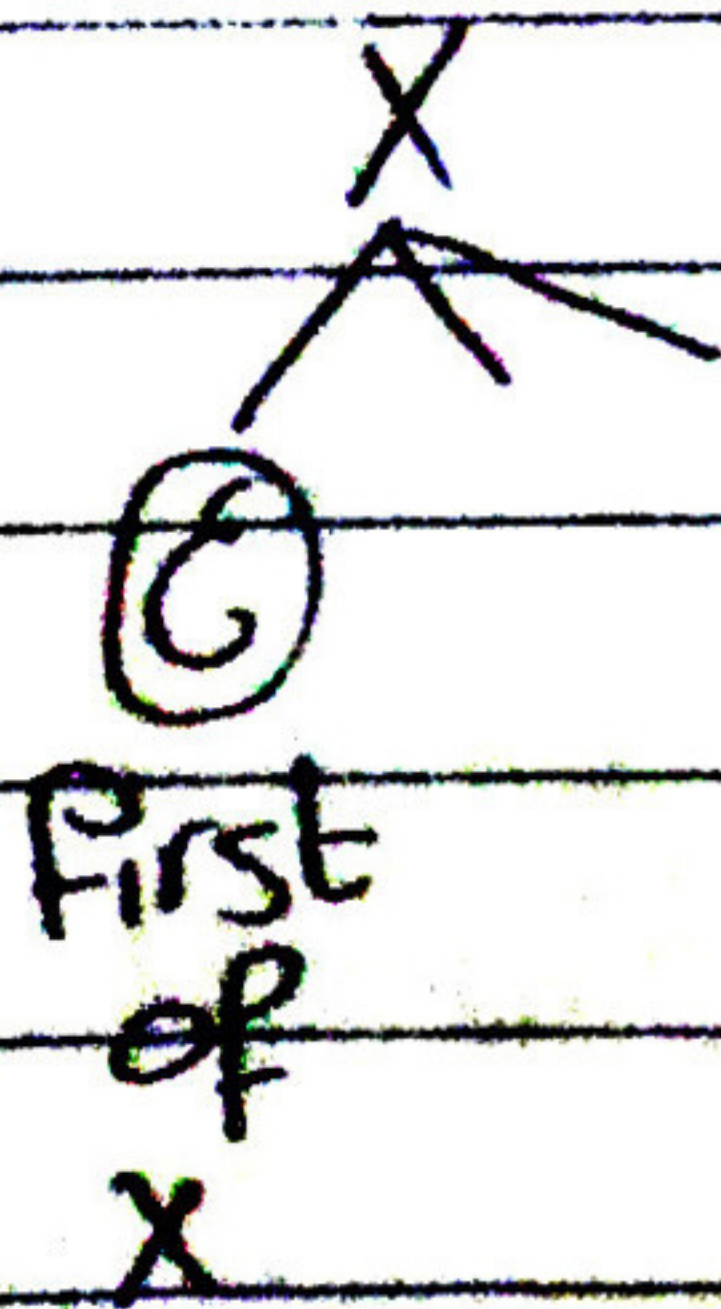
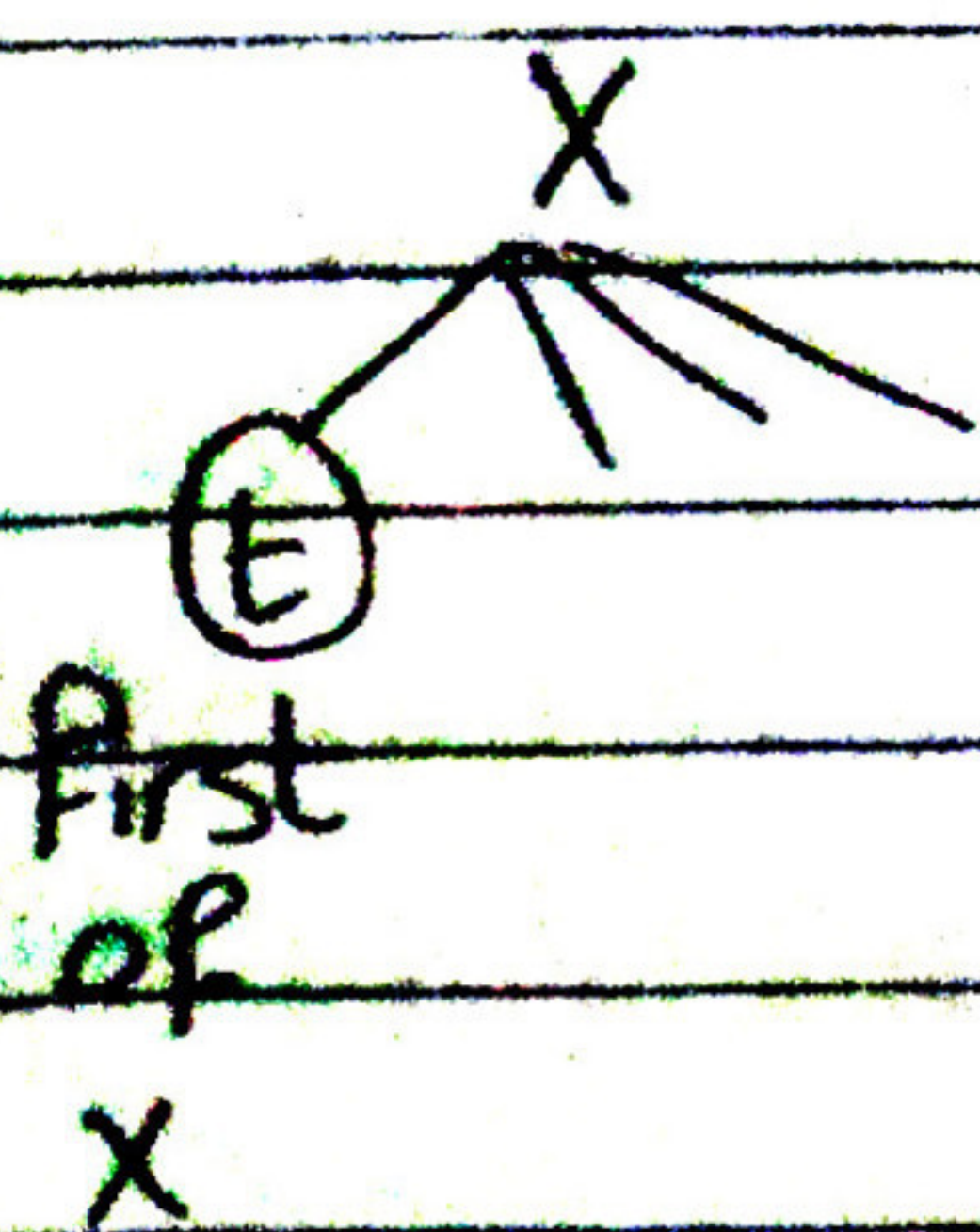
Example :

$\text{int} * (\text{int} + \text{int})$

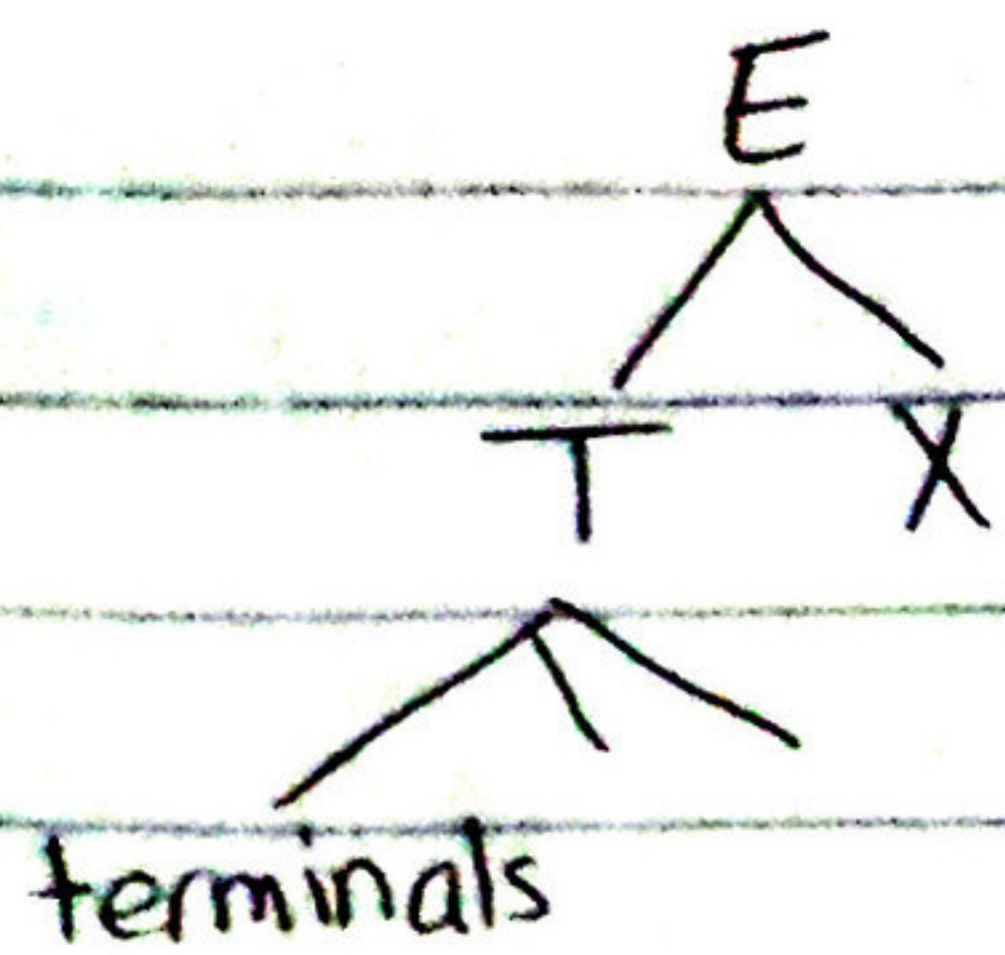
$E \rightarrow TX \rightarrow \text{int} YX \rightarrow \text{int} * TX \rightarrow \text{int} * (E)X$
 $\rightarrow \text{int} * (TX)X \rightarrow \text{int} * (\text{int} YX)X$
 $\rightarrow \text{int} * (\text{int} X)X$
 $\rightarrow \text{int} * (\text{int} + E)X$
 $\rightarrow \text{int} * (\text{int} + TX)X$
 $\rightarrow \text{int} * (\text{int} + \text{int} YX)X$
 $\rightarrow \text{int} * (\text{int} + \text{int})$

First $*$ ال First ال T ال int بق int ال First
 First ال (بق (E) ال First ال T
 بق T

terminals no sets are \neq Follows, Firsts



∴ ε ∈ First of X



لو ال Firsts تابع nonterminal ♥
 * nonterminal يعتبر انه ال Firsts
 بتوع ال * nonterminal الثاني دا ضحيا
 ال Firsts بتوع ال ♥ nonterminal الأول

$$\text{First} (() = \{ (\}$$

$$\text{First} () = \{) \}$$

$$\text{First} (*) = \{ * \}$$

$$\text{First} (+) = \{ + \}$$

$$\text{First} (\text{int}) = \{ \text{int} \}$$

* ال Firsts تابع ال terminals

في نفسها

$$\text{First} (E) = \{ (, \text{int} \}$$

$$\text{First} (T) \subset \text{First} (E)$$

$$\text{First} (T) = \{ (, \text{int} \}$$

$$\text{First} (X) = \{ + , \epsilon \}$$

$$\text{First} (Y) = \{ * , \epsilon \}$$

* لو عندي 2 nonterminals يبقى ال First للثاني من ال Follows تابع الأول

$$\text{Follow} (E) = \{ \$,) \} \cup \text{Follow} (X)$$

$$\text{Follow} (T) = \{ \text{First} (X) - \epsilon \} \cup \text{Follow} (E) = \{ + ,) , \$ \}$$

$$\text{Follow} (X) = \{ \$,) \}$$

$$\text{Follow} (Y) = \{ \text{Follow} (T) \} = \{ + ,) , \$ \}$$

$$\text{Follow} (() = \text{First} (T)$$

$$\text{Follow} () = \text{Follow} (T)$$

$$\text{Follow} (*) = \text{First} (T)$$

$$\text{Follow} (\text{int}) = \{ * , + ,) , \$ \}$$

$$\text{Follow} (+) = \text{First} (E)$$

Construct LL(1) table

1 production rule of nonterminal كل grammar

- ① The parsing table consists of columns (Labeled by the terminals + \$) and rows (Labeled by the nonterminals)
- ② For each grammar rule of the form $A \rightarrow \alpha$ fill in the cells of row A and columns First(A) with α
- ③ For ϵ -grammar rule if $A \rightarrow \epsilon$ Compute Follow(A), fill in the cells that in row A and columns Follow(A) by ϵ

	()	+	*	int	\$
E	TX				TX	
T	(E)				int Y	
X		ϵ	+E			ϵ
Y		ϵ	ϵ	*T		ϵ

$$\text{First}(E) = \{ (, \text{int} \}$$

في الامتحان LL(1) grammar لا check لو هت LL(1) Left factor واحد

عشان اتأكد انه LL(1) table لو كل cell فيها production rule واحد يبقى LL(1)

Ex 8

$$S \rightarrow Sa \mid b$$

	a	b	\$
S		Sa ①	
		b ②	

→ 2 rule
LL(1) لیکن مستلزم